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Herpangina and Short-term Pyrexias of the Summer Months

PRELIMINARY OBSERVATIONS ON THE OCCURRENCE OF THESE SYNDROMES IN SOUTHERN ONTARIO, 1952*

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THE Coxsackie viruses were first isolated by Dalldorf and Sickles in 1947[10]. Since that time, these viruses, which are recognized by their pathogenicity for suckling mice, have been isolated in many parts of the United States, Canada, Europe, Israel, and Australia. Many of these isolations have been made from patients suffering from clinical poliomyelitis; poliomyelitis virus has often been recovered from stools yielding Coxsackie virus. It would appear likely that Coxsackie infections may simulate the abortive and non-paralytic forms of poliomyelitis.

In Toronto we have been interested in Coxsackie viruses since their original discovery. Coxsackie viruses were first isolated from patients suffering from clinical poliomyelitis in Ontario in 1949[2, 25, 27]. In 1950 and 1951 further strains were isolated[26, 28]. It has been possible to type all strains isolated, except one, according to the scheme of classification recommended by Dalldorf[9, 13]. It is evident that strains of Coxsackie virus prevalent in Ontario resemble closely those found in the United States. It might be expected, therefore, that similar clinical syndromes would be encountered.

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It is now accepted that Coxsackie viruses belonging to Dalldorf's Group A, of which there are at least 10 distinct antigenic types, are the aetiological agents of herpangina, an acute ulcerative condition of the throat in children. This condition was first described by Zahorsky[33, 34]. Herpangina has been recognized by clinicians for many years and some reports have appeared in the literature[6, 21]. The original and later reports all referred to the occurrence, between June and the "first frost", of a clinical entity affecting children up to 10 years. The condition was apparently infectious, with an incubation period of 4–10 days. The illness commenced characteristically with fever and vomiting. There was usually headache, and there might be pains in the back of the neck. Lesions were found in the throat, on the soft palate, the anterior pillars, tonsils, or posterior pharyngeal mucosa. The lesions, usually between 2 and 12 in number, began as papules which proceeded to vesiculation and ulceration. The fever usually lasted for 2–4 days and fell by lysis. Throat secretions from some cases were inoculated onto the corneae of rabbits, but no herpes virus was recovered. It was not until the work of Huebner and his associates that the aetiological agent was proven to be Coxsackie virus[4, 5, 8, 15, 16, 17, 23]. These workers have isolated at least four distinct types of Group A Coxsackie viruses from the stools and throat washings of children sick with herpangina, mostly in the vicinity of Washington, D.C. Independent isolations have been made by David *et al.*[11]

Another clinical syndrome caused by Coxsackie viruses, in this instance belonging to Group B, is epidemic pleurodynia (epidemic myalgia or Bornholm disease). First adequately described by Sylvest[29], this condition has occurred in the form of small localized outbreaks in Europe and more recently in the United States. An outbreak occurred in Massachusetts in the summer and fall of 1947.[12] From representative patients, Group B Coxsackie viruses were isolated[22, 32]. Other isolations of Group B Coxsackie viruses have been reported from the United States[19, 20], as well as from Australia[3, 14], England[7], and other countries. The clinical features of epidemic pleurodynia are as follows: fever; headache; paroxysmal pain in chest, abdomen, or limbs.

Another condition which has been attributed to Coxsackie infection is a short-term fever called "three-day fever". The main features of this illness have been headache, fever, and myalgia. For example, Webb, Wolfe, and Simpson[31] described an outbreak in Shreveport, La., in the summer of 1947. Their report relates to 48 children who developed high fever, severe, usually frontal headache, and myalgia, without notable involvement of the respiratory or gastro-intestinal tracts. The illnesses lasted for only 3–4 days. In a later report[30] they refer to the recovery of a Group A Coxsackie virus from 2 patients studied in a similar outbreak in 1948. A somewhat similar entity has been described by Humbert *et al.*[18]. These workers studied over 200 cases in Tennessee in 1946. Fever, "unremitting" headache, myalgia, retrobulbar pain and vomiting, and a vesicular pharyngitis were described. The patients affected ranged in age from infancy upwards. Of interest also is the clinical report of Adamson and McFarlane[1], who observed an epidemic of fever with headache and muscle pain and stiffness, in Manitoba in 1947.

It will be evident that Coxsackie viruses have been incriminated in a number of conditions occurring mainly in children and characterized by varying combina-

tions of the following features: severe, usually frontal headache, myalgia, fever, muscle stiffness and pharyngitis, all lasting for 3–5 days. These syndromes have been most commonly recognized in summer and the early fall. It appeared to us to be of interest to make a definite search for the occurrence of herpangina, pleurodynia, and short-term fevers in Ontario. Accordingly, early in 1952 the medical officers of health of all counties and municipalities within about 100 miles of Toronto were circularized and acquainted with the clinical features of Coxsackie infections. The individual physicians in practice were approached through the medium of the Ontario Medical Review (1952, *19*, 300). One of us (W.W.) undertook to investigate in the field suspected outbreaks or sporadic infections.

This paper records in a preliminary manner the results of our combined clinical and laboratory study of probable Coxsackie infections seen in Southern Ontario during the summer of 1952. We also include some details of an interesting infection that was very prevalent in the City of Brantford, Ontario. No definitive laboratory investigations have yet been carried out, but this report is presented so that practitioners in Ontario and elsewhere may be made aware of the clinical features of this syndrome.

Materials and Methods

(*a*) *Collection of Specimens*

Specimens of pharyngeal secretions were collected with a cotton-tipped applicator; the end was broken off and dropped into a vial containing nutrient broth. Stools were placed in screw-capped jars. Blood was obtained as early as possible after onset of illness and at periods varying from 3–10 weeks later. Samples of throat secretions were shipped to the Connaught Medical Research Laboratories, packed in carbon dioxide ice. Specimens of stool were mailed. Specimens of blood were brought personally to the Laboratories and serum was separated within a few hours. Throat swabs, stools, and sera were stored in the carbon-dioxide ice chest.

(b) *Virus Isolation and Serological Tests*

Specimens of throat secretions were treated for inoculation in suckling mice. simply by adding penicillin (1000 units/ml) and streptomycin (500 μg/ml). Stools were prepared by differential ultracentrifugation in the "Spinco" analytical model centrifuge; the final ultracentrifuged deposit was treated with ether and, if necessary, antibiotics[27, 28].

The suckling mice used for inoculation were obtained from the mouse colonies of the Connaught Medical Research Laboratories and were not more than 48 hours old. Extracts were inoculated cerebrally (0.03 ml) and subcutaneously (0.1 ml). Mice were randomized before inoculation and one litter of 8–10 mice was used for each specimen. Mice were examined daily and killed at the first sign of sickness. Some mice were stored frozen for passage and others were placed in formalin for histology after the skull and abdomen were opened. After fixation, cross sections were taken through the head, thorax, and abdomen; the muscle of two limbs was also taken for embedding. Sections were stained with haematoxylin and eosin. Particular attention was paid to the appearance of the muscle, brain,

dorsal fat pads, and abdominal viscera. It was possible to assign strains of Coxsackie virus to Group A or B on the basis of histology[13].

Several strains of virus pathogenic for suckling mice, and producing characteristic histological changes, are at present being propagated in suckling mice. "Pools" of tissue will be prepared and titrated. To date, five pools have been so titrated (see Tables I and II). Pools of virus will also be tested against the patient's serum so that the titre of neutralizing antibody can be determined. In the one test of this nature that has been carried out, the serum of P.T. was diluted in 10-fold dilutions up to $10^{-4.0}$ and mixed with sufficient homologous virus to give a final concentration of 100 LD_{50}. A 50% neutralization endpoint of the serum was calculated by the method of Kärber[24].

TABLE I

HERPANGINA: TORONTO, 1952,

RESULTS OF EXAMINATION OF THROAT SWABS FOR COXSACKIE VIRUS

Initials, Sex, and Age	*Date of Onset*	*Date of Collection of Throat Swab*	*Results in Suckling Mice**	
			On Primary Inoculation	*On Further Passage*
M.C. (f., 5 years)	August 4	August 5	Group A virus isolated	LD_{50} titre of 2nd passage material $10^{-7.4}$
P.B. (m., 3 years)	August 5	August 9	Negative	
S.C. (f., 2 years)	August 23	August 25	Group A virus	
K.W. (m., 8 years)	About Sept. 2	Sept. 6	In progress	
J.P. (f., 1½ years)	Sept. 7	Sept. 10	Group A virus isolated	LD_{50} titre of 2nd passage material $10^{-7.0}$

*Mice aged 48 hours, inoculated intracerebrally.

TABLE II

SHORT-TERM FEVERS, ONTARIO 1952

RESULTS OF EXAMINATION OF THROAT SWABS FOR COXSACKIE VIRUS

Initials, Sex, and Age	*Date of Onset*	*Date of Collection of Throat Swab*	*Results in Suckling Mice*	
			On Primary Inoculation	*On Further Passage*
B.B. (f., 15 years)	July 23	July 28	Negative	
P.T. (m., 6 years)	July 30	August 1	Group A Coxsackie virus isolated	LD_{50} titre of 4th passage material, $10^{-7.0}$
J.E. (f., 7 years)	July 31	August 2	Group A Coxsackie virus isolated	LD_{50} titre of 2nd passage material, $10^{-6.5}$
L.H. (f., 10 years)	August 3	August 5	Negative	
G.H. (f., 5 years)	August 11	August 11	Group B Coxsackie virus isolated	
L.S. (f., 22 years)	August 28	August 30	Group A Coxsackie virus isolated	LD_{50} titre of 2nd passage material, $10^{-6.0}$
R.E.W. (m., 24 years)	Sept. 1	Sept. 4	Negative	
D.W. (m., 10 years)	Sept. 3	Sept. 6	Negative	

Results

The illnesses studied fall into three main categories: herpangina, short-term fever with pharyngitis or myalgia, and an unusual syndrome encountered in the City of Brantford.

Herpangina

Several suspected cases of herpangina were examined, and in five of these the clinical features suggested the accuracy of the diagnosis. It will be seen from Table I that all the patients were children aged from 1½–8 years. Group A Coxsackie viruses were isolated from three of the five patients (S.C., M.C., and J.P.). The strains appear to be of a high degree of pathogenicity for suckling mice, and pools prepared from the 2nd passage level had LD_{50} titres of $10^{-7.0}$ or higher. Eventually, these strains will be "typed". No epidemiological connection could be discovered between these patients, who were brought to our attention by three physicians on the consulting staff of the Hospital for Sick Children, Toronto. A representative case history is as follows:

M.C., age 5 years, female.

History: Onset August 4, 1952, with abdominal pain and nausea; temperature, 102.5°F. On August 5th the throat was reported to be sore and the neck muscles also painful; on examination there were several circular raised ulcers with whitish-yellow bases and red areolae on the soft palate. A few smaller petechial lesions were seen on the hard palate. The lesions healed completely in five days.

The clinical pictures in the other four children were similar and fitted well the original description of Zahorsky and the later accounts of Huebner and co-workers. Thus, the number of lesions seldom exceeded 12, and the ulcers were located on the soft palate, hard palate, posterior pharyngeal wall, pillars of the fauces, and sometimes on the tonsils. Headache was a complaint in the older children. The illnesses ran a course of 3–5 days, and convalescence was uneventful.

Short-Term Fevers

During the summer we were consulted about many illnesses in children and adults, in which the principal features were as follows: pyrexia of 101°–104°F. for 2–5 days; frontal headache; sore throat; and myalgic pains in the back, neck, abdomen and limbs, without respiratory symptoms. Specimens from 8 such patients have so far been examined by the inoculation of throat secretions in suckling mice. Group A Coxsackie strains were isolated from three patients and a Group B strain from a fourth (Table II). These strains were readily adapted to suckling mice. Particular interest attaches to patient P.T., because acute and convalescent phase sera have been tested for antibody to the strain of virus isolated from the throat swab. The 50% neutralizing titre of the acute phase serum, taken 6 days after onset, was $10^{-2.3}$, and the titre of the convalescent sample, taken 64 days after onset was $10^{-3.1}$. These results suggest that the Coxsackie virus isolated did in fact cause the illness.

"Brantford Fever"

An unusual epidemic occurred in the City of Brantford (population 40,000) in the summer of 1952. In the last week in June practitioners began to see patients

suffering from a clinical syndrome that they had not previously encountered. Patients were seen in increasing numbers until about mid-July; the outbreak came to a close in early September. At a conservative estimate not less than 2,000 cases occurred over this 3-month period. By early August one of us who is in practice in the City of Brantford (A.L.H.) saw between 50 and 60 cases that may be regarded as representative of the larger number. Some differences were observed in the clinical features in the early weeks as compared to later in the epidemic. Patients seen in the first few weeks had an intense headache, usually frontal and unrelieved by analgesics; retrobulbar pain; fever (101°–103°F.) lasting between 2 and 5 days; stiffness of the neck; pain in the back in the absence of respiratory and gastro-intestinal involvement. Some of these early cases suffered from lymphocytic meningitis, and examination of the cerebro-spinal fluid showed a pleocytosis and increase in protein. At this stage in the outbreak the main problem was to differentiate between non-paralytic poliomyelitis and "Brantford fever". A case history of a representative patient follows:

Mr. P., young adult male.

History: Onset with severe frontal headache and pain in the back; temperature, 103°F.; moderate neck stiffness; cerebro-spinal fluid examination: 257 lymphocytes, Pandy, triple plus, sugar, 66 mgm %, chlorides, 690 mgm %, protein, 88 mgm %; peripheral white blood count: 8,800 per cmm, polymorphs, 64%, lymphocytes, 27%, monocytes, 5%, eosinophils, 4%.

Recovery was rapid and uneventful.

Later cases were milder, in that there were generally no signs of meningeal involvement; severe unremitting headache was still the chief complaint. Towards the end of July arrangements were made so that laboratory studies could be performed on patients suffering from this syndrome. Between July 23 and August 6, specimens were collected from 10 patients considered as being typical examples of "Brantford Fever." A representative case history follows:

Mrs. Ba., age 29

History: Onset August 4 with severe "bursting" frontal headache unrelieved by aspirin; retrobulbar pain made worse on movement. August 5, same complaints; temperature of 100°F. August 6, complained of pain in the back, headache somewhat better. Patient recovered completely after an illness of 4 days.

The syndrome affected children aged 4 and upward, but maximum incidence was in young adults (20–40 years). The weather during the greater part of the period of the epidemic was hot and humid, with daytime temperatures over 80°F. The disease appeared to be infectious, as several cases occurred in families and places of employment. Numerous specimens have been collected from the 10 patients referred to, and are being studied for the presence of Coxsackie virus and, if necessary, of other viruses.

Discussion

Studies carried out in Southern Ontario in the summer of 1952 suggest that some of the clinical syndromes of short-term fever, so commonly seen in paediatric and general medical practice in the summer months, are caused by Coxsackie viruses. For example, we have seen children suffering from the clinical syndrome of herpangina of the throat, as described by workers in the

United States. This condition is probably relatively common in the summer months. It would appear that the majority of practitioners are unaware of this condition, and of its aetiology. Our preliminary laboratory studies confirm the presence of Group A Coxsackie virus in the throat secretions of such patients. It seems likely that Coxsackie viruses are also responsible for some of the short-term fevers seen in the summer months, and that are not characterized by herpangina. The characteristic features of these illnesses are fever, severe headache, and myalgia, without respiratory involvement.

We have not yet found in the literature a record of an epidemic exactly similar to that which occurred in the City of Brantford and surrounding district in the summer of 1952, when about 1 in 20 of the population became sick. However, the outbreak that occurred in Giles County, Tennessee, in June and July 1946 appears very similar[18]. The patients in the Tennessee outbreak had severe headache, myalgia, and retrobulbar pain. One feature present in the Tennessee cases, and not noted in Brantford, was vesicular pharyngitis. It is evident that much further study is needed to elucidate the aetiology of short-term pyrexias in the summer months.

The preliminary observations recorded in this paper suggest that viruses of the Coxsackie group play an aetiological role in some such syndromes. The aetiology of short-term pyrexias is complex, and in particular it is difficult to differentiate between the minor illness of poliomyelitis and Coxsackie infections. There are grounds for believing that poliomyelitis virus was not concerned in the aetiology of the short-term fevers encountered in Southern Ontario in 1952, for the year was one of a very low incidence of reported paralysis. In the Brantford area, in particular, only 4 cases were reported during the summer months, none of whom lived in the City of Brantford itself.

Summary

1. During the summer of 1952, the co-operation of medical officers of health and practising physicians in Southern Ontario was sought in the investigation of short-term pyrexias.

2. Particular attention was paid to investigating the role of Coxsackie viruses in the aetiology of these fevers.

3. Five typical cases of herpangina (Zahorsky) were seen in the City of Toronto between July and September. Group A Coxsackie viruses were isolated from the pharyngeal secretions of 3 of these patients.

4. During the summer of 1952 there were many outbreaks of an illness which may be described as "three-day fever". The characteristic features of these illnesses were as follows: fever lasting 2–5 days; headache, usually frontal; sore throat, and myalgic pains in the back, neck, abdomen, and limbs, in the absence of respiratory or gastro-intestinal involvement. Virus studies have been completed on eight such cases and Group A Coxsackie virus isolated from three patients, and Group B virus from one patient. Serological tests showed an increase in homologous neutralizing antibody in convalescence in the one patient so far tested.

5. An epidemic of a short-term pyrexia with somewhat unusual characteristics affected the City of Brantford during the summer of 1952. It is estimated that

approximately 2,000 out of a population of 40,000 became ill. The illness occurred in children, but predominantly affected young adults. The predominant clinical features were intense frontal headache, retrobulbar pain, fever lasting between 3 and 5 days, and myalgia. Some patients had in addition meningeal involvement with pleocytosis and increased protein in the cerebro-spinal fluid. No virus studies have yet been completed, but the general characteristics of the outbreak suggest that it was in fact a virus infection.

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Nursing Today and in the Future

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NURSING has reached one of the most exciting phases in the history of the profession while at the same time the most frustrating to the nurses and those they work with, as well as the public they serve. Especially in public health. It is no longer necessary to sell our services; to a great extent they are being sought after. We have developed within our universities facilities for preparation of public health personnel that a little over thirty years ago did not exist. Financial assistance is now available for those who wish to grasp these opportunities. The federal grants-in-aid program offers the means whereby much that we wished for in the past can now be provided. Then why the frustration? Is it perhaps that we have gone too far too quickly?

Certainly when we review the scientific knowledge at our disposal and relate this to the extent to which we have translated what we know can be, into action, it would be difficult to say that our speed has been excessive. We have been making a valiant effort. However, is it not possible that, in attempting to grasp the multitude of opportunities facing us in all directions, we have at times found ourselves going round in circles rather than driving straight ahead? There is nothing so frustrating as working to the limit and often beyond the limit of one's physical and mental resources without the satisfaction of real accomplishment.

How can we get off this merry-go-round that for many of us describes the majority of our days? It seems to me that there is only one way. Stop and take stock! Take time to select that course which will be productive with the resources at hand. This need not prevent planning for a steady development of our programs as time and personnel permits. But the essentials must be done first in spite of the many enticing possibilities that tempt us around the edges.

What are the essentials? Public health was very certain at one time. In the early stages of its history, sanitation, followed closely by the control of communicable diseases, formed the essential core of public health nursing, while at the same time bedside nursing care in the home extended nursing service from the hospital to the community. With the rapid developments in scientific knowledge, medical personnel sought for ways and means to channel this fund of information to the people, and the teaching function of nurses in the community came into being. There was so much to tell the people. We were and are filled with it. We spew forth great avalanches through every possible media and at every opportunity. And at the same time we complain that we have so much to

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give but so few seem interested. Is this perhaps because during this period of rapid growth in our knowledge we have lost sight of the essentials? Is the public developing a deaf ear because of the constant bombardment of vast quantities of information which to them seems unrelated to their basic health needs? What does the public consider the essentials?

We haven't all the answers, but we are going in the right direction. We are searching for basic information about health needs and services. Each province has carried out a comprehensive health survey. Research has shown healthy signs of trying to get at the principles on which we should base our action. Before 1948, something less than a million dollars was the Canadian total annual expenditure on all types of health research. In 1952, Canada will spend over three times as much, according to the Hon. Paul Martin, Minister of National Health and Welfare. Public health workers have had at their disposal for over two years a Study of Public Health Practices in Canada. Only a small proportion of the answers are here, but it is my belief that the Study does establish effectively many of the essentials that, if selected and used as a basis for our planning, would go a long way to eliminating some of the frustration facing us.

How far have we taken it seriously? How far have we tried to interpret the nursing aspects of this report with our administrators in order that we may correct the deficiencies that were pointed up and put the recommendations into effect?

Research itself is valueless unless the data are translated into action.

For example, the report indicated that maternal welfare was perhaps the weakest point in our public health programs. Yet no one would deny that the primary function of the public health nurse is to promote and preserve the health of children. It has been demonstrated that, to attain the greatest long-term results, our energies should be directed to the pre-natal period, followed by the post-natal and pre-school as time and personnel permit. What are we doing about this basic failure in our public health program? Of course, we can blame someone else for the fact that our maternal welfare program is weak. After all, the medical officer of health sets the pace, the family physician calls the tune, the public pays the piper. But do they entirely? If public health nurses sincerely believe that they have a real contribution to make to the public's health in this regard, then they can sell the idea to others by the sheer force of their conviction, and by demonstrations that cannot be ignored. If public health nurses now do not feel secure enough in their knowledge and skills to speak out against conditions that keep them from their primary function, then they must demand, of universities and their employers, opportunities to prepare themselves, so that they can face the questioning faces of parents knowing that they, better than anyone else, can give guidance and support.

And if the individual nurse feels she can make little headway by herself, where does she turn? What is the Ontario Public Health Association for? Surely not to bring you together for a pleasant visit or even to hear a few speakers, no matter how valuable their contribution may be. An organization of public health workers is of value only in so far as it furthers public health work. It can become and remain strong only as the members do something about their problems. If they haven't enough facts, they must gather them. If it is a nursing problem and

enough facts are available to draft a solution, then together they should seek the support of the other workers within their community, the province and, if need be, the support of all public health workers across Canada through the Canadian Public Health Association. Although not mighty in numbers, the C.P.H.A. is listened to with respect in many quarters. A recommendation from the Canadian Public Health Association is seriously received and studied in Ottawa, and with a rapidly developing national health plan a sound recommendation of the public health nursing section of the Ontario Public Health Association could find support and have long-term results.

Of course, you cannot do all that here today. However, you can indicate an area you'd like to work on. Then go home and get started in your own community. Talk about it. See how others feel about it. Recently I was speaking to the Nursing Administration Section of the Ontario Hospital Association and I made a plea for physicians, nurses, and representatives of voluntary and official health agencies to get together. It seemed to me that the time has come for the professions to get right down to discussing the available personnel in a specific community and how best they could be utilized for the betterment of the people they serve. No dreams of what might be if we only had enough nurses, or equipment or cars, etc., but with the resources now available find out what is possible in one community if all plan and work together. And it isn't necessary for nurses to wait for others to start the process. I have recently heard of two conferences of just this sort—one to be held in Welland and one to be held in St. Catharines, in which representative nurses from the hospital, the official and voluntary public health agencies, industry, etc., were getting together and taking a family situation as a basis for their discussion. They hoped to find out how they could better serve the family by working in cooperation and in a coordinated manner. To me this is an exciting development. Here nurses are getting together and trying to do something about providing better nursing service for their community. Such action, I believe, can forestall others establishing controls without the knowledge the professional group has to offer, and perhaps based on personal desires and ambitions.

If nurses in their own communities come to grips with a problem and find a solution, it should be shared through our provincial association. We can add our efforts together to a greater sum. Let's do something about nursing service in Canada besides complain about the present. It is an exciting time to live in. Together we can make the future of nursing more satisfying for all concerned.

The Role of the Veterinarian in the United States Public Health Service

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THE idea of a veterinarian as a member of the public health team is not a new concept. One of the earliest references to the need of veterinarians in public health was made in 1884 by Frank S. Billings, a Boston physician, in his book "The Relation of Animal Diseases to the Public Health, and Their Prevention." This view was reiterated in 1941 by Haven Emerson in his report "The Health Needs of the Nation."

Like its human counterpart, veterinary medicine made rapid advances following the opening of the field of bacteriology in the late nineteenth century. Early in the twentieth century the close inter-relationship of human and bovine tuberculosis was recognized. It was agreed that the control of the disease in cattle was essential to the eradication of the bovine type of disease in man. On the basis of these observations, the first milk sanitation programs were inaugurated under the supervision of veterinarians. The program emphasized two points: the tuberculin testing of cattle, and later the heat treatment of milk (pasteurization). The successful control program that followed, and of which we are justly proud, has been one of veterinary medicine's greatest contributions to public health.

The development of veterinary public health activities in the Public Health Service dates from 1925 when four veterinarians were brought into the Service to assist in the development of a milk sanitation program. The veterinary activities have continued to expand and now include many other food sanitation problems in the environmental health field. A second milestone of veterinary activities in the Service was the assignment in 1936 of two veterinary parasitologists to the National Institutes of Health. Their activities were mainly in the field of medical parasitology, but included attention to certain animal parasitic diseases that are communicable to man.

With the advent of World War II, new and additional responsibilities were assigned to the Public Health Service. The services of additional qualified veterinarians were required in the expanding programs, particularly in milk and food sanitation. Diseases encountered in the world-wide theaters of war and by military governments emphasized the need for additional investigation and control work in animal diseases transmissible to man.

Recognizing the need for such investigations in the United States, the Public

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Health Service established a classification for veterinary officers in its Commissioned Corps in 1946. Starting with a small nucleus, the officer in charge was delegated the responsibility of developing programs for the investigation and control of animal diseases of public health significance. This broad assignment included the establishing of research programs to provide basic knowledge, field investigations of control procedures, liaison and consultative services with other divisions within the Service, and assistance to the States, particularly in the establishment of veterinary public health programs. Additional assignments have included the administration of the Interstate Quarantine Regulations and consultation to the Foreign Quarantine Division on problems that relate to animals, the investigation of the processing of certain animal products, and liaison on veterinary affairs.

Appropriate phases of these veterinary activities are now integrated into operating programs of the Communicable Disease Center, the National Institutes of Health, and the Division of Sanitation.

The National Institutes of Health carry on the basic medical research programs of the Public Health Service. Veterinarians in this organization are working on research problems which contribute to our basic knowledge of the etiology, transmission, and pathology of those diseases of animals transmitted to man. These diseases have been defined by the World Health Organization as "Zoonoses." In addition, studies of the diseases of laboratory animals, including the neoplasms, are contributing collateral knowledge which may be applicable in combatting similar human diseases.

The Communicable Disease Center, as its name implies, is the national headquarters of the Public Health Service for the field investigation and control of infectious and parasitic diseases of man. The Veterinary Public Health Section of the Epidemiology Branch conducts field and laboratory studies, as mentioned heretofore. These activities include wildlife control programs, epizootiological investigations of diseases of public health significance, and assignment to epidemiological teams studying human diseases believed to have animal reservoirs.

As the field of epidemiology broadens, the importance of the veterinarian as a member of the epidemiological team becomes more apparent. The veterinarian can ably assist the epidemiologist in the investigation of such problem diseases as leptospirosis, brucellosis, Q fever, and many others.

The prevention, control, and study of food-borne diseases are activities in which veterinarians of the Public Health Service are playing a major role. Currently, laboratory investigations are being carried on to determine the prevalence of the *Salmonella* group of organisms in meat and poultry products. Studies are also being carried out to determine the efficacy of our present milk pasteurization temperatures. These diseases in man may be partially controlled through adequate inspection of meat, poultry, and milk. However, they can be fully controlled only when inspection is combined with the control of animal diseases on the farm.

From the inception of veterinary public health activities in the Service, every effort has been made to help the States keep abreast of problems and progress in this field. In addition to serving as a clearing house for nation-wide veterinary public health problems, the Veterinary Public Health Section has, from time to time, assigned veterinary officers for duty with State health departments. Many

of these departments to which our officers were assigned on a temporary basis have since drawn up plans for permanent veterinary public health programs on a State-wide basis. To date, twenty States have inaugurated veterinary public health programs within their health departments.

The Veterinary Public Health Section of the Communicable Disease Center is cooperating fully to augment the efforts of similar organizations in the international health field. Liaison is maintained with the Veterinary Section of the Pan American Sanitary Bureau, and with the veterinary program of the World Health Organization. One of our officers has just completed a 3-month assignment with WHO. His services were requested to assist in the development of rabies control programs, and improve laboratory diagnostic procedures in several countries in the Middle and Far East.

With the advent of atomic energy came the need for coordinated investigations in the field of radiological health. In addition to the national defense aspects of the effect of radiation on living tissue, we must consider the need for increased knowledge of the peacetime uses of this great force. Veterinarians working with experimental animals have contributed materially to our knowledge of the effects of radiation. A veterinary officer is currently assigned to studies of the fundamentals of radiology.

Within the budgetary limits of the Service, veterinarians are being trained in our schools of public health to appreciate the value of professional teamwork in the solution of major public health problems.

It can be said in summary that veterinary medicine is playing an important role in preventive medicine. Veterinary activities in the Public Health Service have been principally in the following fields of activities:

1. Communicable disease control, with primary emphasis on the control of those animal diseases transmissible to man.
2. Public health research.
3. Administration of interstate quarantine regulations that relate to animals.
4. Sanitation, especially as it pertains to food products of animal origin.
5. Liaison with Federal and State veterinary agencies, professional groups, and practitioners.

Veterinary medicine has a definite role in the composition of a public health team. The veterinarian, like the physician, the dentist, the nurse, and the engineer, can make a worthwhile contribution to the preventive medical program. As more and more veterinarians are integrated into public health teams, the tempo of our fight against those diseases which have animal reservoirs will be increased.

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Child Health Services in New Brunswick

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BOTH extremes of life present their peculiar health problems. In New Brunswick, the problems presented by the aged remain largely untouched, apart from free cancer diagnostic clinics, a limited program of treatment for certain types of cancer, and some additional facilities for looking after mental patients. On the other hand, children's services—perhaps because they are more honoured by tradition, and perhaps also because it is a very human failing to single them out for attention when the contrast is made and only very limited resources are available—continue to occupy an important part of our total health program in the province.

New Brunswick has a population of little over half a million people, of whom about one quarter are children. Consequently, our program in maternal and child health applies to a very large part of our population. The services that we offer are patterned after those that have been tried elsewhere, but we have adapted them to conditions found in New Brunswick. We fully realize that our Division of Maternal and Child Health Services forms a part of a general public health program. Its director acts as co-ordinator in cooperation with the local health services. Many features contain nothing that is new, and it will be obvious to you that we are far from solving all our problems.

One of our most embarrassing problems is our infant deaths. During 1950 there were 927 deaths of infants under one year of age—approximately twice the number of deaths from cancer in the same year. Our rate was 56.5 per 1,000 live births, the lowest it has ever been in the province, but still the highest in Canada except for Newfoundland. The rate for Canada was 41. Although our present infant mortality rate of 56.5 does not place us in an enviable position in the Canadian picture, it is still the lowest we have had and represents considerable progress over the rate of 113.3 which prevailed thirty years ago.

Dr. Ruth McDougall, Director of Maternal and Child Health, has made a detailed study of the medical causes of infant deaths in the various parts of the province and has discussed her findings at meetings of the local medical societies.

In the three cities in the province in 1950, the infant mortality rate was 32.7 per 1,000 live births. In provincial towns (1,000 population and under 10,000 population) the rate was 38.8. The rural rate was 65.3, increasing over the previous year in nine of our fifteen counties and decreasing in six. The county rate varied from 29.2 in Albert County to 101.2 in rural Restigouche County.

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Dr. A. F. Chaisson, Director of Communicable Disease Control, has brought together some interesting figures which cast some light on this wide range of infant mortality rates in the different rural counties. These figures are contained in our Health Survey Report for the province which has just been released by the Federal Government, and I shall not refer to them in detail. In general, they show that the rural counties with the higher birth rates, poorest physician-coverage, larger percentage of children born without medical attention, lowest per caput incomes, and poorest educational levels, have the higher infant mortality rates. The reverse seems true, again in a general way, of the counties with the lower infant mortality rates. The educational and economic level of the local population in various parts of the province no doubt influences the rates there, as elsewhere.

The five main causes of death in infants under one year of age in New Brunswick are:

Respiratory diseases	18.7%	
Immaturity	15.3%	
Ill-defined and unknown causes	16.4%	
Diarrhoea and enteritis	9.2%	
Congenital malformations	8.7%	68.3%
Other specified causes		31.7%

In connection with the problem of immaturity, we made a survey to determine how many hospitals in the province had a sufficient number of baby incubators. It was found that nearly all needed more and better equipment. Thirty-six incubators were subsequently supplied, through the Federal Health Grants. They should be of at least some demonstrable value. A dozen of the larger hospitals are keeping records of the premature births and survival rate; the forms are supplied by the Maternal and Child Health Division and are returned annually. This was started in 1950, and it will provide a more exact measure of the problem.

It has been shown that many women who eat an inadequate diet during pregnancy are more likely to have a premature infant. I am afraid that too many doctors take no cognizance of this fact when providing care for women during pregnancy. We have a nutrition program under the direction of the Division of Maternal and Child Health, and an effort is made to coordinate educational work in nutrition with the problems of that division. In addition, with an eye to the future, we started a school lunch program in the province in 1945. In the city schools the home economics teachers supervise this program and in the rural areas the nutritionists of the Department of Health look after it. The lunches provided under the program are supplemented by the carried lunch. It must be appreciated that we do not anticipate that all nutrition problems can be overcome by this. It is hard to evaluate the program, but it is an attempt to foster better eating habits.

We are not particularly proud that diarrhoea and enteritis are among the five main causes of infant mortality in the province, but such is the case. To improve the situation, we are advocating measures well known to you all, and gains have been made in recent years. Not all of these cases occur in isolated rural areas with poor sanitation. During the past year we had one outbreak, with three

deaths, in the nursery of one of our hospitals. As in most places, our hospitals are overcrowded.

Another of the five main causes of death in infancy, death from unknown or ill-defined causes, is a matter of concern, since 16% of the deaths in 1950 were due to this cause. There are large rural areas in the province with only one physician to as many as 3,000 to 4,000 persons—a situation that up to the present has not been remedied, although it is a subject of study by the New Brunswick Medical Society. Incidentally, the development of the program in maternal and child health has received very good co-operation from the medical profession of the province.

New birth registration forms adopted this year require congenital malformations, the fifth main cause of infant deaths, to be reported at the same time as the birth. This will enable us to start treatment earlier. The information thus becomes available to the Director of Maternal and Child Health, who administers the Crippled Children Grant. In our province, all of this grant is used each year and in 1951–52 we spent an additional $15,000 for treatment, hospitals, doctors, prosthesis and transportation where necessary. The patients are asked to help if they can, to permit available funds to be spread further. The greatest co-operation was received from the Junior Red Cross, the Shriners' Hospital, Montreal, and the service clubs of the province.

We in New Brunswick believe that one of the most important contributions we are making to child health is through the child conferences which are conducted by the public health nurses. These are being carried on monthly at the present time in 98 different places in the province. They not only provide education for new mothers, but also aid them by supervising the care of their babies, in co-operation with the medical profession. The conferences are also the main centres for the immunization program, and facilities for immunization are always available. The immunization program is carried out mainly by the public health nurses, who give the inoculations and also vaccinate. We believe that they do this very efficiently and, in our province at least, it is the only practical way to secure widespread coverage of more remote areas. Department personnel alone are completing inoculations in 14,000 annually, vaccinating 15,000, and giving reinforcing doses to 16,000. It is true that we still have occasional cases of diphtheria in the province, but our rate is very low. Among other things, the child conferences stress the importance of beginning immunization by the third month, and larger numbers of children are being done at earlier ages annually, as the effects of the conferences make themselves felt in more and more communities. In 1950, which was an epidemic year, there were 19 deaths from whooping cough, of whom 12 were of infants under 6 months.

Routine physical examinations are not carried out in the schools of the province. Formerly there was a system of school medical examinations, but it has been given up in favour of what amounts to an inspection of pupils by the public health nurses for defects that need medical referral. Routine vision testing is also done by the public health nurses, so that those with visual defects or abnormalities may have them remedied. The nurses also do a considerable amount of health education, devised mainly to help the teacher to teach health principles more effectively. The department carries out physical examinations of all the student

teachers at Teachers' College annually, but this, we consider, is part of their teacher-training course.

On the staff of Teachers' College there is a public health nurse who has been a teacher, has a certificate in public health, and is qualified in supervision and administration in public health.

We are attempting to lay greater stress on the role of the teacher in the school as the key person in the health program. Through alert observation, the teachers are able to discover and refer to the public health nurses any deviations from the normal, either physical or mental. These referrals are closely followed up by the public health nurses and, if necessary, referred to the District Medical Health Officer or private physician.

Children needing treatment for tuberculosis receive it free in hospital, as do adults. While in hospital, provision is made for them to carry on with their school work.

The provincial government provides hospitalization and prosthesis for poliomyelitis patients, as well as orthopaedic consultants and remedial surgery.

The services which I have described are still far from perfect, but what I have said will give you some idea of the direction in which we are working. Throughout our program, we recognize that improvement of health conditions in our communities must be a cooperative and joint effort of health workers and parents. Without parent participation in the program, our efforts would be largely ineffective. All departmental activities are integrated with that important purpose in view.

What Should Tommy Eat?

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THE newer knowledge of nutrition, based on the results of hundreds of research projects, is beginning to provide us with a clear and concise answer to the question "What should Tommy eat?" Those actively engaged in health work are becoming increasingly aware of the importance of the food he eats to Tommy's physical and mental well-being. If Tommy is to be well-nourished, it is necessary that the food that he eats every day, year in and year out, shall contain all the essential nutrients in abundance and also that this food shall be well digested and absorbed and shall be carried to the tissues in all parts of his body.

Since good nutrition is impossible unless food furnishes an adequate amount of each of the essential food factors, the Canadian Council of Nutrition, which serves in an advisory capacity to the Minister of National Health and Welfare, has approved a new dietary standard for Canada.[1] This standard is based on the opinions of the most reliable authorities on the subject and recommends amounts of calories, protein, calcium, iron, vitamin A, thiamin, riboflavin, niacin, ascorbic acid, and vitamin D, which individuals of various body sizes need each day.

To provide a basis for selection of foods to meet the daily needs, as listed in the dietary standard, a simplified guide, Canada's Food Rules, was adopted by the Canadian Council of Nutrition in 1944. Canada's Food Rules, as shown below, are based on servings from five major food groups, milk, fruit, vegetables, cereals and bread, and meat, plus a source of vitamin D. The term "serving" used in the Rules gives ample leeway to provide for widely divergent needs according to age, sex, size, and degree of activity. Each of these food groups contains a wide variety but whatever combination of foods is chosen for a day's menu it should include servings from each of these groups. The omission of any group may be a very serious handicap to growth and health.

For the purposes of this paper it will be considered that Tommy is a five-year-old boy. A comparison will be made between his needs, as listed in the dietary standard, and the amounts of the essential nutrients provided by the food groups listed in Canada's Food Rules. This comparison will prove that Canada's Food Rules are an excellent basis for feeding Tommy, that a mother cannot go wrong using the Rules as a foundation for her menu planning. Each food group contributes to the total of essential nutrients and it will be found that all of Tommy's

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requirements are met with the exception of calories and calcium. Extra servings of the basic foods, with some sugars and starches, make up the extra calories and three-fourths of a cup of milk will make up the extra calcium.

Canada's Food Rules

These foods are good to eat.
Eat them every day for health.
Have at least three meals each day.

1. MILK

Children (up to about 12 years)	at least 1 pint
Adolescents	at least 1½ pints
Adults	at least ½ pint

2. FRUIT

One serving of citrus fruit or tomatoes or their juices; and
one serving of other fruit.

3. VEGETABLES

At least one serving of potatoes; and
at least two servings of other vegetables, preferably leafy, green or yellow and frequently raw.

4. CEREALS AND BREAD

One serving of whole grain cereal; and
at least four slices of bread (with butter or fortified margarine).

5. MEAT AND FISH

One serving of meat, fish, poultry, or meat alternates such as dried beans, eggs and cheese.
Use LIVER frequently. In addition:
EGGS and CHEESE at least three times a week each.
VITAMIN D—At least 400 International Units daily for all growing persons and expectant and nursing mothers.

Approved by the Canadian Council on Nutrition, 1950
Nutrition Division, Department of National Health and Welfare, Ottawa.

The following foods have been chosen for this comparison:

Milk Group:	1 pint whole milk
Fruit Group:	½ small orange
	¼ cup applesauce
Vegetable Group:	1 small potato
	¼ cup beets
	¼ cup green beans
Cereal and Bread Group:	½ cup rolled oats
	3 slices bread
	½ ounce butter or margarine
Meat or Alternates Group:	2 ounces ground beef
	3/7 egg
	1/7 ounce cheese
Vitamin D Group:	400 International Units

The average size of servings for a five-year-old child has been used. As you can see, these are quite ordinary foods that might appear on the average table. None were chosen for exceptionally high nutrient content.

The Table of Food Values Recommended for Use in Canada[2] was used to obtain the nutrient value of each of the foods listed. Results have been tabulated and are given in Table I. From Table I percentage figures were calculated and these are given in Table II. An examination of this table will show how important is the contribution of each group in the overall total.

Group I—Milk. Milk contributes more to Tommy's diet than any other single food. It is outstanding as a source of calcium, riboflavin, protein, thiamin, and vitamin A. Although sufficient quantities of thiamin and vitamin A may be furnished in other foods, it is almost impossible and very expensive to furnish Tommy with adequate calcium, protein, and riboflavin without milk.

One pint of whole milk provides 70% of Tommy's calcium requirement. It is to be noted that the other food groups provide relatively little of this mineral. Some vegetables are quite good sources of calcium but could not begin to replace milk. If Tommy's milk consumption is raised by ¾ cup, bringing it up to 3¼ cups, 100% of the calcium requirement will be met. For calcium safety, then, Tommy should have 3½ to 4 cups of milk daily. More than 4 cups of milk is not necessary as an excess of milk may easily crowd out other foods.

One pint of whole milk contributes 126% of the riboflavin requirement. The meat group is the only other fair source of this vitamin. Without milk only 43% of Tommy's requirement is met. As this vitamin, riboflavin, is extremely sensitive to light, much of it may be lost by leaving the morning milk on the doorstep in the sun.

Milk is also a good source of the best quality protein, contributing 52% of Tommy's daily requirement. Without milk it would be necessary to get that protein from meat or eggs, which are generally more expensive per gram of protein.

Skim milk contains as much protein, calcium, and riboflavin as whole milk. When whole milk is skimmed, calories are reduced and all of the vitamin A is removed. Tommy's vitamin A requirement can be well covered without milk —that is, with extra margarine or butter or green and yellow vegetables—and it is possible for him to make up the lost calories with other foods. So skim milk may be used in place of whole milk when economy is necessary, as skim milk may be purchased at a little over half the cost of whole milk. The use of skim milk may mean the difference between Tommy's having insufficient milk and his getting enough milk to meet his daily needs.

Group II—Fruit. The outstanding contribution of this group is vitamin C or ascorbic acid. This vitamin is found in large quantities in citrus fruits. One half a small orange provides 20 mg. of ascorbic acid and this represents 66⅔% of Tommy's total requirements. With ¼ cup of applesauce contributing 16⅔%, the total contribution for the fruit group is 83%. One half orange daily can, therefore, be considered an ample serving for five-year-old Tommy, if he is also being given sufficient vegetables. It can easily be seen that without one excellent source of ascorbic acid in the diet, it would be impossible to reach the 100% mark. Tomatoes, raw, cooked or canned, tomato juice, or raw cabbage are also excellent sources of ascorbic acid and can be used in place of citrus fruit occasionally. Since ascorbic acid is not stored by the body, a daily source of this vitamin is a necessity. Fruits are also important in Tommy's diet for their roughage value.

Group III—Vegetables. Vegetables are important chiefly for iron, vitamin A,

TABLE I

COMPARISON OF DIETARY NEEDS OF A 40-LB. (5-YEAR-OLD) BOY WITH AMOUNTS OF NUTRIENTS* SUPPLIED BY FOODS LISTED IN CANADA'S FOOD RULES

Foods and Amounts	Calories	Protein	Calcium	Iron	Vit. A	Thiamin	Riboflavin	Niacin	Vit. C	Vit. D
Milk, whole—1 pint	381	20.6	.696	.6	945	.23	1.005	.6	6	..
Orange, ½ small (1/8 lb.)	18	.36	.013	.16	77	.032	.012	.09	20	..
Applesauce—¼ c. (2 oz.)	29	.15	.003	.15	45	.02	.015	.1	5	..
TOTAL Fruit Group	47	.51	.016	.31	122	.052	.027	.19	25	..
Potato—1 small (2 oz.)	47	1.1	.006	.4	11	.06	.03	.7	6	..
Beets—¼ c.	22	.57	.009	.4	12	.007	.012	.07	3	..
Green Beans—¼ c.	13	.63	.017	.88	258	.02	.025	.2	2	..
TOTAL Vegetable Group	82	2.3	.032	1.68	281	.087	.067	.97	11	..
Rolled Oats—½ c. (¾ oz.)	68	2.4	.008	.8	..	.12	.03	.1	..	..
Bread, white—3 slices	240	7.5	.027	.6	..	.06	.06	1.2	..	..
Butter—½ oz. (on bread)	108	.1	.003	..	500	..	..	..	..	..
TOTAL Cereals and Bread Group	416	10.0	.038	1.4	500	.18	.09	1.3	..	..
Ground Beef—2 oz.	104	11.06	.006	1.65	..	.045	.096	2.7	..	..
Egg (average 3/week)	31	2.4	.01	.51	219	.017	.055	..	..	..
Cheese—1/7 oz. (1 oz./week)	15	.94	.027	.04	53	.001	.017	..	..	..
TOTAL Meat Group	150	14.4	.043	2.2	272	.063	.168	2.7	..	..
Vitamin D—400 I.U.	..	..	..	..	..	..	..	..	..	400 I.U.
Total supplied by C.F.R.	1076	47.81g.	.825g.	6.19mg.	2120 I.U.	0.612mg.	1.357mg.	5.76mg.	42mg.	400 I.U.
5-year-old (40 lbs.) needs**	1600	40g.	1.0g.	6.0mg.	1300 I.U.	0.5mg.	0.8mg.	5.0mg.	30mg.	400 I.U.

*Figures taken from "Table of Food Values Recommended for Use in Canada," published by Nutrition Division, Department of National Health and Welfare, Ottawa.

**Figures taken from the "Canadian Dietary Standard."

and vitamin C. One small potato, ¼ cup of beets and ¼ cup of green beans contribute 28% of the iron, 22% of the vitamin A, and 37% of the vitamin C requirements. The vitamin A contribution is very important. Vitamin A is found in abundance in dark green and yellow vegetables and these should be included in Tommy's diet often.

Vegetables make a significant contribution of vitamin C. If properly cooked, potato can contribute about 6 mg. daily to the diet. Because vitamin C is destroyed rather quickly by oxygen and by heat, the vegetable group should not be counted a too reliable source of this vitamin.

Fruits and vegetables, because of a similarity in vitamin and mineral content, can be used interchangeably to some extent. If Tommy wishes to eat a second serving of fruit and not eat his vegetable, no harm will be done. However, this does not apply to citrus fruits, as Tommy eats so few other foods that contain large quantities of vitamin C.

Group IV—Cereals and Bread. Cereals and bread are important items in Tommy's diet because of their energy value, protein, iron, and thiamin. One half cup of rolled oats and 3 slices of bread with butter or fortified margarine provide 26% of the calories, 25% of the protein, 23% of the iron, and 36% of the thiamin. The 38% vitamin A contribution is from the butter included in this group. A whole-grain home-cooked type of cereal was chosen because its cost is less for the food value received and ready-to-eat cereals may or may not contain the whole grain.

Apart from the milk, the rolled oats is the largest single contributor of thiamin. Without this serving the thiamin intake is dangerously close to the minimum. If the milk consumption is low at the same time, it is very difficult for Tommy to obtain sufficient thiamin.

Although this group is not the largest contributor of protein, still it is to be noted that without this group the protein intake would fall below 100%.

Group V—Meat and Alternates. This group is most important for its 36% protein and 37% iron. Abundant growth will take place more satisfactorily if Tommy eats an abundant supply of protein. This group will supply 36% of his requirements. Without sufficient meat or alternates, protein intake falls too low. If milk, which supplies 52% of the protein, is also lacking or taken in insufficient quantity, there may be protein undernutrition. When protein is low, iron is often low too, and anaemia may result from lack of sufficient iron. The meat group supplies 37% of Tommy's iron requirement.

Although milk and meat are both high-quality proteins, they cannot be used interchangeably. Meat does not contain sufficient quantities of calcium, and milk is low in iron. An adequate amount of each must be included in Tommy's diet, that is, three to four cups daily of milk and at least two ounces of meat or alternates daily.

The inclusion of liver once a week, as suggested in Canada's Food Rules, would considerably increase the percentages for vitamin A, iron, and the B vitamins, as this food is an extremely good source. This serving of liver would be insurance against insufficient intake of those vitamins.

Eggs and cheese, both high-quality proteins, are also included in this group. Eggs also contribute significant quantities of iron, vitamin A, and riboflavin. If possible, an egg a day should be included in Tommy's diet.

TABLE II

A Percentage Comparison of Total Nutrients Supplied by Food Groups Shown in Table I with the Dietary Needs of a 40-lb. (5-year-old) Boy

		Calories	Protein	Calcium	Iron	Vit. A	Thiamin	Riboflavin	Niacin	Vit. C	Vit. D
Milk Group	Total	381	20.6	.696	.6	945	.23	1.005	.6	6	..
	%	24	52	70	10	73	46	125	12	20	0
Fruit Group	Total	47	.51	.016	.31	122	.052	.027	.19	25	..
	%	3	1	2	5	9	10	3	4	83	0
Vegetable Group	Total	82	2.3	.032	1.68	281	.087	.067	.97	11	..
	%	5	6	3	28	22	17	8	19	37	0
Cereals and Bread Group	Total	416	10.0	.038	1.4	500	.18	.09	1.3	..	..
	%	26	25	4	23	38	36	11	26	0	0
Meat Group	Total	150	14.4	.043	2.2	272	.063	.168	2.7	..	..
	%	9	36	4	37	21	13	21	54	0	0
Vitamin D	Total	..	..	..	..	..	..	..	..	..	400 I.U.
	%	0	0	0	0	0	0	0	0	0	100
Total of Food Groups		1076	47.81g.	.825g.	6.19mg.	2120 I.U.	0.612mg.	1.357mg.	5.76mg.	42mg.	400 I.U.
Total Percentages		67	120	83	103	163	122	169	115	140	100
5-year-old (40 lbs.)		100%–1600	40g.	1.0g.	6mg.	1300 I.U.	0.5mg.	0.8mg.	5.0mg.	30mg.	400 I.U.

Vitamin D. The dietary standard calls for 400 International Units of vitamin D daily for Tommy. As this vitamin cannot be obtained in the usual foods, some other source must be used. Any form of vitamin D, a synthetic form or a fish-liver oil authorized by Tommy's physician, would be suitable. Direct sunshine falling on the skin forms vitamin D in the body, but in this country the months of available sunshine are short and this cannot be counted a reliable source of vitamin D. Care should be taken not to give Tommy an overdose of this vitamin as it may be dangerous and it is most certainly wasteful and expensive.

Extra Foods. So far there has been little mention of calories. Canada's Food Rules will provide Tommy with only 67% of his need. They were never intended to be used as a maximum food intake but rather as a nucleus for menu planning, a list of protective foods which could provide the user with the assurance that he or she was eating well and that all the essential needs would be met. Tommy will no doubt wish to eat extra foods over and above those used in this comparison. It is better, though, that he be given more of the basic foods rather than sweet, fatty, or starchy foods. One cup of milk, one peanut butter sandwich, and one banana, will provide Tommy with those extra calories and at the same time raise the percentages of the other nutrients. These extra nutrients can be called a "margin of safety".

Sweets. The amount of sugar that is used in sweetening fruits or in simple desserts is all that Tommy needs. The inclusion of sweet desserts, candy, and soft drinks should be delayed as long as possible, as Tommy develops a "sweet tooth" soon enough without being encouraged. Sweets also are thought to be one of the primary causes of tooth decay, both because of their immediate effect on the enamel of the tooth and because they dull the appetite for the foods necessary to make and keep teeth sound.

The same foods that were eaten in early childhood should continue to be the basis of the diet during school age. The quantities, however, should be increased to take care of the child's greater needs as he grows older. Were a similar comparison to be done between an 11-year-old school child's needs or the needs of an adolescent, and the nutrients provided by the food listed in Canada's Food Rules, there would be similar percentage results. The only difference would be in the size of servings used.

There is no doubt that we could exist on two or three foods if we knew which ones and how much of each we needed, but parents should be encouraged to give the child a variety of foods so that they can be sure that all nutrient needs are well covered. The child's appetite is a good guide as to how much he needs, but he must be given a good variety. If Tommy sleeps well, plays with vigour, has a good appetite, and has the general appearance of well-being, parents can consider that he is healthy and that he is eating enough of those foods which he needs.

Canada's Food Rules, shown by this comparison to supply the needed nutrients daily, is our answer to "What should Tommy eat?"

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New Approaches to Health Evaluation of Insecticides

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TECHNICAL CHANGE is the order of the day, and I would venture that this is no more true of any field of endeavour than it is of the pest control field. Your techniques have moved forward with every advance in knowledge of chemistry and entomology. Thus, today you are employing the most recent discoveries in organic chemical synthesis. It is our task in the Department of National Health to help you employ these new compounds with safety, for in spite of the many practical entomological advantages which they offer, the new compounds frequently possess many times the toxicity of those used in past years. Some have specific toxicity for the enzyme systems of living matter; others are associated with new vehicles and activators which often possess a toxicity of their own.

History of Pest Control Chemicals

A study of the history of your science as summarized by Shepard in his book, "The Chemistry and Action of Insecticides", shows the trend which has taken place toward products of higher insecticidal power and higher human toxicity.

Stone tablets dating farther back than 1000 B.C. have referred to red squill as a rat poison. Homer spoke of sulphur for fumigation and the Romans applied hellebore for control of rats, mice, and insects. In 900 A.D. the Chinese were using arsenic to control garden pests. A record of 1669 describes the use of arsenic with honey as an ant bait. It is of particular interest that the first potent enzyme poison, nicotine, was used in 1690 in the form of tobacco as a contact insecticide and in 1778 as a fumigant by heating tobacco and blowing the smoke on infested plants.

In 1822 mercuric chloride and alcohol were recommended for killing bedbugs. The first reference to phosphorus, as a paste for rodent control, was a Prussian Government order of 1845.

At the half-way mark in the 19th century, that important stage in the development of the science of chemistry, new and more complex compounds, having higher toxicity to living matter, appear in the history of pest control. 1854 saw carbon disulphide employed as a grain fumigant and 1877 marked the first use of hydrogen cyanide. Lead arsenate appeared in 1892. Though tarred paper was used for banding trees as early as 1800, the active agents

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of tar—the phenols and cresols—had to await developments of science for their isolation. This was accomplished in 1867 and the potassium salt of the more complex compound 4, 6 dinitro-0-cresol appeared in 1892. It was the first of a new family of specific organic poisons notable for the presence of the potentially-toxic benzene ring.

Among the slower-acting inorganics of relatively high toxicity, fluorine compounds came into prominence in 1896 and selenium in 1925. Marking an advance toward more effective but potentially-dangerous application procedures, airplane dusting against catalpa sphinx was instituted at Troy, Ohio, in 1921.

The First Chlorinated Hydrocarbon Insecticide

The forerunner of the modern rapid-acting chlorinated hydrocarbon insecticides appeared in 1912 as p-dichlorobenzene. This marked a further advance in chemical synthesis and understanding of insect toxicology.

There followed in 1927 the discovery of the fumigatory powder of the simple chlorinated hydrocarbon, ethylene dichloride, and in 1932, methyl bromide, which was first employed in France and has continued to find application up to the present in spite of the extreme danger in its use. Finally, it may be noted that nicotine, the first neuro-toxic agent, was fixed in 1930 as nicotine tannate for use as a stomach poison and was combined with bentonite in 1934.

Wartime Developments

It is well known what effect wartime shortages had on the development of pest control chemicals. Accelerated research for derris substitutes was undertaken and resulted in active work on the chlorinated hydrocarbon family. The insecticidal toxicity of benzene hexachloride was discovered in France in 1941 and independently in England in 1942. DDT, synthesized by Ziegler in 1874 and described as an insecticide by Müller in 1936, was restudied and its amazing properties were revealed. Following the war, chlordane, toxaphene, aldrin, dieldrin and others of this chemical family have come into prominence.

A different approach in Germany—the search for human enzyme poisons of chemical warfare usefulness—ultimately resulted in the organic phosphate insecticides following the war. A number of these materials were developed by Schrader during the early war years, and parathion (0-0-diethyl-o,p,nitrophenyl-thiophosphate) has found wide application in orchard pest control since 1948.

Turning to rodent control agents, a most notable advance was made in the application of the anticoagulant, dicumarol, which had earned a position of importance in clinical chemistry.

New Approaches in Evaluation of Toxicity

It would be inappropriate on this occasion to go into the detail of the insecticidal and rodenticidal toxicity of the compounds in current use, nor do I propose to weary you with comparisons of the mammalian toxicity possessed by the wide range of agents available to today's pest control operator. I believe it will be more valuable to outline the experiences which we have had in the Industrial Health Laboratory in assessing toxicity and attempting to establish the hazard to the user.

In 1949, the National Health Department assumed the task of acting as consultants to the Plant Products Division of the Federal Department of Agriculture in connection with the administration of the Pest Control Products Act. We first set out to evaluate the toxicity of candidate products by a study of experimental protocols covering mammalian toxicity data supplied by the manufacturer. It became rapidly clear that the industry was in many instances presenting data from experiments improperly planned to reveal the many aspects of human toxicity known to be of importance. For instance, there was a preponderance of data on the effects of oral ingestion of pure material when it was evident that grower, pest control operator, or the public in contact with residual insecticide, would experience low-level exposure to the trade mixture by the dermal or respiratory route as well as orally.

Demand for the new products has been high. Toxicity study is time-consuming and costly. As a result, fullest investigation of all aspects relating to human toxicity has not been possible prior to licencing. Thus, it became necessary to institute confirmatory experiments and more searching metabolism work at Government level. This was commenced and the Industrial Health Laboratory is now equipped with an up-to-date unit for mammalian toxicity studies.

Toxicity of Trade Formulations

The initial work with submitted experimental protocols and early laboratory study in Ottawa has demonstrated one important fact—that many vehicles, emulsifiers and process impurities may exert an appreciable effect on the toxicity of insecticides. This was, of course, not an entirely new observation.

In 1943 a U.S. Army team under P. A. Neal found that the addition of sesame oil in certain percentages to freon solutions of DDT increased the toxicity of the insecticide to mice. Gertler and Haller have shown that some benzamides exert a strong synergistic effect on pyrethrum. Turner and co-workers reported the effect of some polyethylene glycols on the toxicity of nicotine to insects. Some increased the toxicity while others decreased it. Deichmann has reported that certain emulsifying agents may reduce the cutaneous toxicity of organic phosphate insecticides to rabbits. Hazelton has shown that the acute oral toxicity of certain organic phosphate insecticides in corn oil is five times that in propylene glycol. Ingle states that the insect repellent, dimethyl phthalate, reduces the dermal toxicity of chlorinated hydrocarbons.

While numerous examples of this kind are known, little emphasis appears to have been placed on the significance that this augmenting of the effective toxicity of an insecticide may have on the mammalian toxicity and ultimately on the individual handling the material. A thorough knowledge of the augmenting or inhibiting action that vehicles, emulsifiers or impurities may have on the oral, dermal and inhalation toxicity of insecticides could dramatically alter our conception of the toxicity and effectiveness of the trade formulation.

It is evident that the potential danger from a marketed insecticide depends not only on the inherent toxicity of its active ingredient, the inherent toxicity of the associates and the synergistic contribution, but also on the concentration in which the mixture reaches a critical centre in the organism which it is attacking. This latter aspect is generally a physical factor related to solubilities in

tissue or particle size in relation to lung penetration. If the theoretical toxicity is modified upward or downward by this combination of factors, the hazard to the person exposed will probably vary in the same way. In fact, the laboratory toxicity of the active ingredient of an insecticide may be a poor guide when we are attempting to assess the hazard of a particular formulation of that toxicant in the field.

Experiments in the Industrial Health Laboratory

In our toxicology laboratory under the direction of Dr. W. L. Ball, we have carried out biological assays on several formulations of the chlorinated hydrocarbon, aldrin, to assess their comparative toxicities in relation to the pure compound. A chronic feeding experiment employing groups of rats on levels of 5, 10 and 20 parts per million of recrystallized material from the manufacturer was run for six weeks with no apparent effect on the rats. At the end of this period 2.5% wettable powder was substituted in the diet of the animals for the pure material. A marked weight loss was observed at the 20 part per million level at the end of the first week. Subsequently, the rats at this level showed an increase in weight over the controls and the rats at the lower levels. Investigation has continued for several months. The rats given 20 parts per million have continued to increase in weight over the controls, in spite of having frequent convulsions. Rats on 10 parts per million also exceeded the weight of the controls.

These results led us to suspect that some formulations of this new compound might be more toxic than others. Literature reports showed the LD50 of pure material to be 65 milligrams per kilogram. We found that the LD50 of 2.5% wettable powder was approximately 15 milligrams per kilogram or approximately 5 times as toxic as we had expected it to be. That of the recrystallized material was 56 milligrams per kilogram, while that of the technical grade which is claimed to be about 95% pure was 58 milligrams per kilogram. Later work showed the LD50 of 20% aldrin wettable powder to be 26 milligrams per kilogram. From this work it appears that the toxicity varies greatly with the type of formulation.

When these findings were brought to the attention of the manufacturer, an investigation of the source of the active material used in the formulations was made. It was found that the high toxicity formulations had been produced by an earlier aldrin synthesis process. This process apparently yielded a product containing highly toxic impurities which resulted in an effective toxicity substantially higher than that of recrystallized aldrin.

The current aldrin formulations possess the lower toxicity and have been prepared by the new process.

Our findings on this compound have led us to instigate a long-range investigation on a large number of insecticides. Early dieldrin formulations have been found to be approximately three times as toxic in the 2.5% wettable powder form as in the pure form. Five per cent chlordane, on the other hand, appeared to have a LD50 of about 500, which was expected. Several formulations of benzene hexachloride were evaluated and in all cases the LD50 was about 150 as expected. One of these benzene hexachloride formulations was 25% wettable powder, another was a form of paper fumigant containing 16% of BHC. Several or-

ganic phosphate insecticides have been evaluated and parathion 15% wettable powder was found to have approximately the expected LD50 or 3 milligrams per kilogram. Tetraethyldithionopyrophosphate had an LD50 of 7 milligrams per kilogram as expected. The systemic insecticide Systox had an LD50 of approximately 15, which compared very closely with the value of 14.7 reported in the literature. Of all the compounds tested to date, only aldrin and dieldrin have had toxicities which were higher than one would have expected from the literature reports. We are continuing to examine other insecticides as they become available.

The Toxicity in Field Application

A second most important point which I would like to stress is the fact that laboratory studies, valuable in comparing toxicity and elucidating metabolism, cannot measure the influence of application procedures used in the field. This is an aspect on which no manufacturers have yet provided satisfactory data in relation to their products. As such information was absolutely necessary, the Federal Government had the Industrial Health Laboratory initiate field experiments in which different methods of application would be studied and the hazard estimated. Such a study was carried out during the last growing season in connection with the use of parathion for plum curculio control in Quebec apple orchards. Studies of this type may well become necessary in the pest control field in the future, and for this reason I shall briefly outline our St. Hilaire experiments.

It has been known for some time that parathion depresses the level of the enzyme cholinesterase in mammals and humans. Knowledge of the relationship between parathion exposure in the field and cholinesterase response is, however, sparse. A few investigators have determined levels of parathion in the air of orchards under conventional spraying conditions and in plant atmospheres. Others have studied cholinesterase levels among persons handling the compound. Our study represented a combined investigation providing information on the anti-cholinesterase effect of parathion in known concentrations in air for a group of sprayers in the St. Hilaire-Rougemont area of the Province of Quebec.

The experiments were carried out under normal field conditions where parathion was sprayed in the concentration one to one and one-half pounds per hundred gallons at the rate of approximately 300–400 gallons per acre. The hand sprayer and rocking-type mechanical sprayer were employed. Levels in air from 2 gamma per litre to 15 gamma per litre were found during spraying, as high as 26 per litre during filling and decimal quantities residual; these amounts depending largely upon wind conditions. It was observed that spraying was carried out less frequently in relation to weather conditions than to the exigencies of the pest situation.

Thirty-four sprayers were exposed to the environmental concentrations of parathion described. In general these persons sprayed for two days in ten, on five occasions during May and June 1951. Personal protective measures varied.

Cholinesterase levels in the plasma and red cells were determined on three occasions during the spray period and twice afterwards—at the end of July and end of October. Health experience was explored. A control group consisting of

forty-one Ottawa civil servants provided cholinesterase levels in July 1951, October 1951, and February 1952.

The three average cholinesterase levels for the control group matched. The two average cholinesterase levels for the sprayers during the unexposed periods of July and October agreed with the levels for the controls.

A significantly lower level of cholinesterase was found for the sprayers during the exposed period to the extent of approximately twenty-five per cent. This finding bears comparison with health experience which revealed that seventeen out of thirty-four sprayers did not complain of ill-effects; of the remaining seventeen, having slightly lower average level of cholinesterase as a group, most reported signs such as headaches and nausea on one or more occasions, or in a few instances were confined to bed with mild non-specific illness for a few days. It is possibly reasonable to claim on the basis of health experience and blood findings that marginal intoxication was experienced by the group, even though the spray formulation was as low as any in use on the continent. It may be that the hand and mechanical rocker-type equipment results in high exposure. New equipment may reduce the hazard. During the current season, investigation of Turbomist and Speed sprayers will be carried out to determine how operator exposure compared with the St. Hilaire conditions.

New application procedures are growing in variety each year. There is pressure for airplane dusting with such agents of high toxicity as parathion. Sale of pill forms of insecticides which can be vaporized by burning has been recently proposed. Aerosol preparations are on the increase. Continuous vaporizers for use in public places are being exploited actively.

Obviously each form of application demands the most careful consideration and cautious action on licencing, for compounds of low comparative toxicity may prove highly toxic to man if ingested or inhaled over long periods of time. Compounds of high comparative toxicity dispersed in exceedingly low concentration may indeed prove highly toxic if the exposure is of long duration. Those classes of pesticidal chemicals known to be rapidly metabolized in the body may appear to be safely tolerated on this account if concentration is low enough to avoid evident effect, but health officials are duty-bound to consider the implications in having added to the internal environment of the body, a foreign substance requiring to be constantly or even intermittently metabolized. We view with concern those compounds known to be capable of being stored in the fat and other tissues and particularly those characterized by chronic or delayed toxic effects. These are among the many considerations with which health officials must deal in carrying out the responsibility of protecting the industrial worker who manufactures, the formulator, the pest control operator, the grower —and the citizen exposed to residual material in public or domestic environments or ingesting residues on food.

At the present time, licencing authority in both the United States and Canada emphasizes the primary consideration of ensuring that the label on the product is a true and proper description of the contents of the container and its insecticidal powers. Additionally, this legislation requires that precautionary measures and antidotes shall be clearly described. It is an age of risk. Insecticidal toxicity has not yet been found in a compound without some measure of human toxicity.

The practical realities appear to demand that economic importance must be balanced with safety. This is most effectively reached among experienced and organized users such as the pest control group who, as professional operators, are in a position to maintain safety-consciousness and suitable precautions in use of dangerous chemicals.

Some experts today suggest that the toxicity of these important economic aids is such as to justify that their application be made a matter of licence. Whether this would be practical and effective at this stage is a question which cannot easily be answered solely on the basis of recent user experience. If, however, the human toxicity of insecticides increases in the future, best opinion holds that such a course would become a necessity.

Canadian Journal of Public Health

INTERNATIONAL CERTIFICATES OF VACCINATION

FROM time to time, physicians are asked for certificates of vaccination by persons who purpose travelling in other countries. By international agreement, six "quarantinable" diseases have been recognized. These diseases are smallpox, cholera, yellow fever, plague, typhus and relapsing fever.

Vaccines are used as protection against smallpox, cholera and yellow fever. These vaccines include two in which living virus is employed. It is essential that the vaccines be fully potent and that the vaccinations be performed by physicians. In the instance of yellow fever, vaccination must be carried out in the special centres where the administration of the vaccine can be carefully controlled.

Revision of the International Sanitary Conventions was initiated in 1946 by a committee of the World Health Organization. The revision and consolidation into one text applicable to all means of transport involved a vast amount of work. Thirty-six meetings are recorded in the minutes of the Special Committee, and additional meetings of a sub-committee were held. The Canadian delegate to this Special Committee was Dr. H. D. Reid, Chief, Division of Quarantine, Department of National Health and Welfare, with Dr. J. B. Bundock, Canadian Immigration Medical Officer at The Hague, as alternate. At the Fourth World Health Assembly, the text was unanimously adopted on May 25, 1951, by the representatives of the sixty governments present, and it was agreed that the Regulations would enter into force for all member states on the first day of October, 1952.

Important revisions were made in the international certificate of vaccination against smallpox. The new certificate requires the date of vaccination, professional status of the vaccinator, and information as to whether it was a primary vaccination or a re-vaccination and, if primary, whether successful. There is a space on the certificate for an approved stamp. The form of the stamp used must be approved by the health administration of the territory in which the vaccination is performed. The health administration, in so far as Canada is concerned, is the Department of National Health and Welfare, and the approved stamps are:

(1) Department of National Health and Welfare, Canada, Quarantine Service.

(2) The official stamp of any municipal or provincial health authority, which stamp should preferably give the name and location of the health unit.

Vaccinations against smallpox and cholera which are carried out by a medical officer of the Armed Forces are signed by the medical officer concerned, with his

rank, and validated by a stamp bearing the name of the Department of National Defence, Canada, Medical Services.

In regard to the stamping of certificates of vaccination, there has been some confusion about the responsibility of the medical officer of health. Some have interpreted the requirement as necessitating actual reading of the reaction, and, in consequence, revaccinations have frequently been performed. It is clear, however, that what the international certificate asks for is confirmation of the professional status of the vaccinator. In Canada this requirement means that the medical officer of health, in stamping an international certificate, is certifying that the vaccinator was duly qualified to perform such service. Often physicians do not use the standard form of certificate, not appreciating the fact that to be of maximum value, the international form must be used, completed in full, signed by the vaccinator, and bearing the imprint of an approved stamp. The new certificate, like the former one, is valid for a period of three years, beginning eight days after the date of a successful primary vaccination, or, in the event of a revaccination, on the date of that revaccination.

Certificates of vaccination against cholera also require to be on the international forms, signed by the vaccinator and bearing the imprint of the approved stamp.

Yellow fever vaccination is performed in the centres which have been established in Canada by the Department of National Health and Welfare for the convenience of those requiring it. These centres are located in medical establishments of the Department of National Health and Welfare in Halifax, Saint John, N.B., Quebec, Montreal, Ottawa and Vancouver, and are located in medical establishments of the Department of Veterans Affairs in St. John's, Nfld., Toronto, Winnipeg, Regina, Calgary and Edmonton. As the vaccine must be fresh and must at all times be kept below freezing temperature, it is distributed to the centres, packed in dry ice. It is desirable that the traveller give the centre advance notice of his intention to be vaccinated. The certificate is not valid until ten days after the date of vaccination, except in the case of persons reinoculated within a period of six years.

The new international certificates are now available. It is desirable that physicians who are asked for international certificates of vaccination should obtain a supply of these forms from the Quarantine Service of the Department of National Health and Welfare, Ottawa, and fulfil the regulations by having the medical officer of health or other health authority place the approved stamp in the appropriate space on the certificate. In this way, those requiring certification of vaccination will encounter the minimum of difficulty when entering other countries.

Copies of the International Sanitary Regulations, constituting the proceedings of the special committee, are available from the World Health Organization.* Provincial and other public health authorities will find much of interest and profit in these proceedings. The minutes of various meetings show the difficult problems which had to be solved in revision and consolidation of the Regulations. One additional quarantinable disease has been included, namely, relapsing fever, making in all six diseases for which maritime quarantine applies. Part 1 of the volume comprises the debates of the special committee and its sub-committee, and Part 2 gives the text of the International Sanitary Regulations, with an explanatory memorandum and an analytical index.

*Agents in Canada: The Ryerson Press, 299 Queen Street West, Toronto. Price $2.25.

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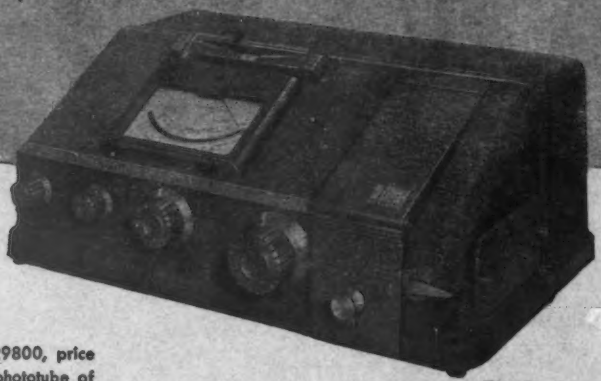

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